

Ask Dr. ALOHA:

Choosing a Level of Concern

If you're an experienced ALOHA user, here are two questions for you:

*How often have you plotted a footprint in ALOHA without first choosing the **Level of Concern** that would be most appropriate for your scenario? Do you*

instead just accept ALOHA's default value?

In this article, you'll see why you should think of a Level of Concern, like wind speed or puddle area, as required input for an ALOHA scenario.

What IS a Level of Concern, Anyway?

A Level of Concern is a “threshold concentration” of an airborne pollutant, usually the concentration above which a hazard to people is believed to exist. ALOHA's **footprint** represents the area within which, at ground level, the predicted concentration of the pollutant in the atmosphere exceeds whatever Level of Concern you set, as shown in Figure 1 below. If the Level of Concern you've chosen is a concentration above which a hazard is thought to exist, then the footprint represents the predicted area where people might be exposed to that hazard.

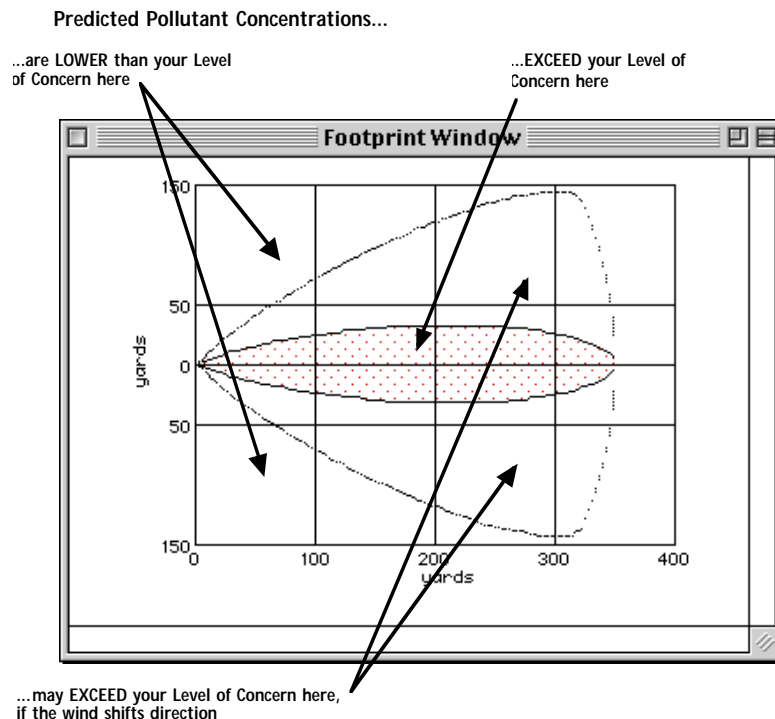


Figure 1. An ALOHA footprint plot, showing where pollutant concentrations are higher or lower than the Level of Concern.

You Can Use an Exposure Limit as Your Level of Concern

The most commonly-used kind of Level of Concern for air modeling is an **exposure limit**. Each exposure limit has a specific definition, but very generally, each in some way reflects the effects of a toxic substance on people. A variety of exposure limits have been established by government agencies and professional organizations.

The **Immediately Dangerous to Life or Health (IDLH)** limit was established by the National Institute for Occupational Safety and Health (NIOSH), and is the “default” Level of Concern in ALOHA. IDLH values have been established for 219 of the 904 chemicals in ALOHA’s chemical library. A chemical’s IDLH represents the maximum concentration in the air to which a healthy adult worker could be exposed for a short period without suffering permanent or escape-impairing health effects.

Once you choose a chemical in ALOHA, its IDLH (if one has been established) is displayed in the Text Summary window, as shown in Figure 2. (In the Text Summary window, you also may see a value for the Threshold Limit Value–Time-Weighted Average (TLV-TWA), another common workplace exposure limit established by the American Conference of Governmental Industrial Hygienists (ACGIH). This limit is defined as the average airborne concentration to which workers can be repeatedly exposed for 8 hours each day and 40 hours each week, without adverse effects.)

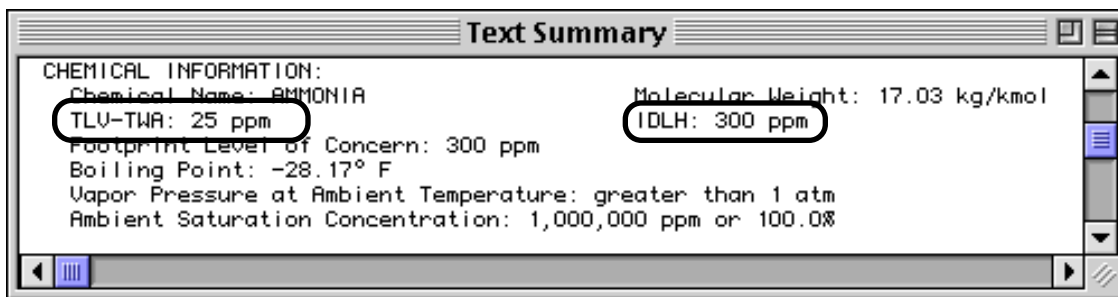


Figure 2. ALOHA’s Text Summary window, showing the IDLH, as well as the TLV-TWA, for ammonia.

If an IDLH has been established for the chemical you have selected, *ALOHA will automatically use it as the Level of Concern for your release scenarios unless you enter a new value*. You can enter a new Level of Concern or view the Level of Concern that ALOHA will use for your scenario by choosing **Options...** from ALOHA’s **Display** menu. In Figure 3, you can see that ALOHA is using the IDLH of

ammonia as its Level of Concern, by default. To change this value, you would just type in another Level of Concern, then choose appropriate units.

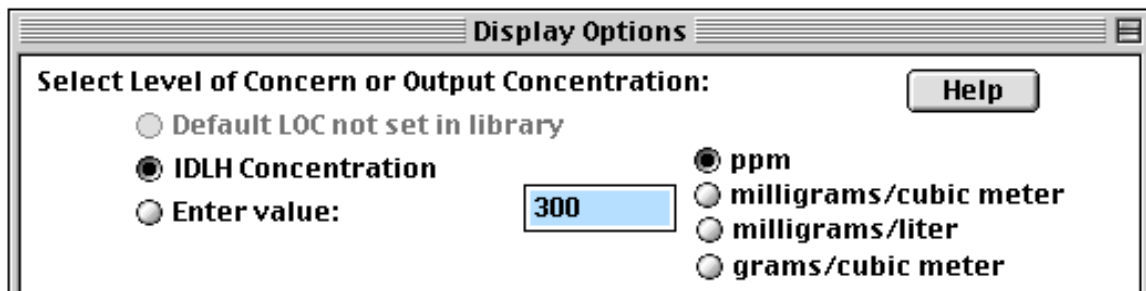


Figure 3. ALOHA's Display Options window, showing ammonia's IDLH of 300 ppm as the Level of Concern.

You also can use ChemManager to permanently add your own Level of Concern for any chemical to ALOHA's chemical library, as shown in Figure 4. To do this, start up ChemManager, click on the name of the chemical, click **Modify**, then select Default Level of Concern, type in your new value, click **OK**, and then click **OK** again.

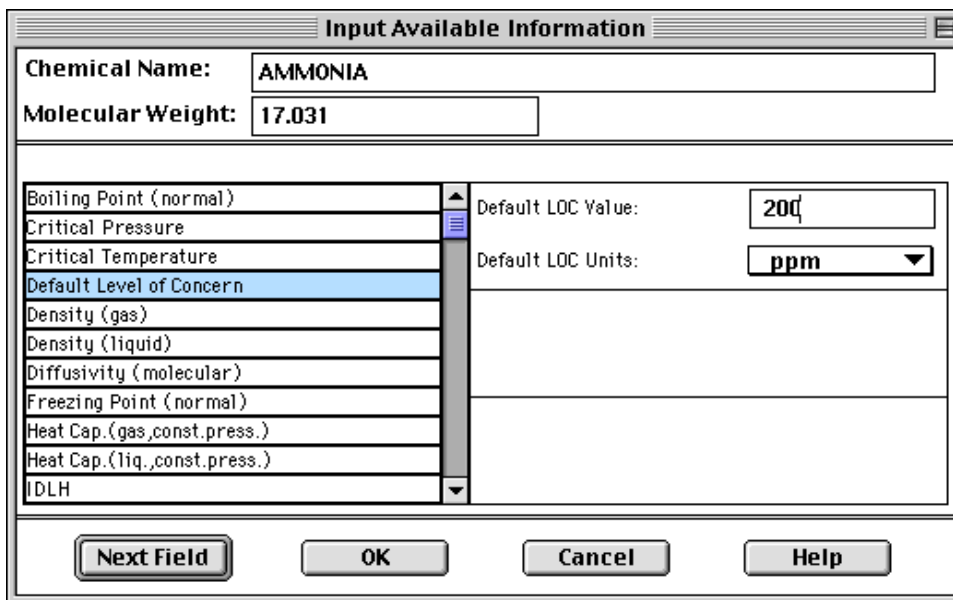


Figure 4. Using ChemManager to add a new default Level of Concern for ammonia to ALOHA's chemical library. This value, 200 ppm, is the ERPG-2 value for ammonia.

Once you have added your own Level of Concern for a particular chemical to the library, ALOHA will use it, rather than the IDLH, as the default Level of Concern for that chemical (and you will see this value, rather than the IDLH, whenever you check your display options as above).

Consider Other Levels of Concern

Although ALOHA makes it easy for you to use the IDLH as your Level of Concern, don't just accept this value without thought! Another exposure limit or other kind of concentration value may be the best Level of Concern for your purpose. If you have access to the Internet, you can learn more about exposure limits and other kinds of potential Levels of Concern by viewing the following web page: <http://response.restoration.noaa.gov/cameo/locs/LOCpage.html>.

As you evaluate a potential Level of Concern for use in ALOHA, ask yourself whether it makes sense in the context of your work. To predict the area of a hazard or other effect, you must first decide what the hazard or effect is, and then make sure that the Level of Concern reflects it. For example,

- if you're modeling a chemical's toxic hazard during an emergency response, you may wish to choose a toxic exposure limit such as the Emergency Response Planning Guideline value (ERPG) or Threshold Limit Value–Short-Term Exposure Limit (TLV–STEL).
- if you're modeling a substance's explosion hazard, you might wish to choose a fraction of its lower explosive limit (LEL) as your Level of Concern.
- if you want to identify locations where people may be especially concerned if an accidental release occurs, you may wish to choose a detection limit such as the odor threshold.
- if you're preparing consequence analyses to meet provisions of the Risk Management Planning Rule ("RMP Rule"), be sure to use as your Levels of Concern the toxic endpoints listed in the rule for the chemicals you're working with.

Account for Contact Duration

The duration of contact with a pollutant, as well as the pollutant's concentration, affects how it may harm people. For that reason, exposure limits designed to reflect toxic hazard usually have specific **contact durations** assigned to them, to indicate that the harm is expected to be caused when the limit is exceeded for the contact duration or longer. For example, the contact duration associated with ERPGs is 1 hour, and that associated with TLV-STELs is 15 minutes. The IDLH contact duration is not specifically defined, but is on the order of the brief times typical of emergency response.

A Level of Concern's contact duration should be appropriate for emergency response use. After an accidental chemical release, people downwind may be exposed to high concentrations of the chemical, but typically for only a brief period. A Level of Concern with a contact duration much greater than an hour or so is probably not appropriate for use in ALOHA, unless a release occurs over a relatively long time span.

If you have access to the Internet, you can learn more about contact durations associated with exposure limits by reading the following web page:

http://response.restoration.noaa.gov/cameo/dr_aloha/conc3/conc3.html .

Account for the Population of Concern

Finally, be sure that the Level of Concern that you'd like to use is as appropriate as possible for the population you're concerned about and your task at hand.

There are two basic kinds of exposure limits:

- **workplace exposure limits** (such as the IDLH, TLV-TWA, or TLV-STEL). These are usually defined for healthy adult workers, and typically incorporate **safety factors** to ensure that workers won't be overexposed to hazardous chemicals in the workplace. Generally, employers are responsible for ensuring that these limits are not exceeded in the workplace.
- **public exposure guidelines** (such as the ERPG). These are intended to predict how members of the general public would be affected if exposed to a particular hazardous chemical. Generally, public guidelines are used for tasks like air modeling and other kinds of consequence analysis, when the goal is to assess the severity of a hazard to the general public.

During emergency response or planning, your goal may be to predict how the general public would be affected by an accidental release of a particular hazardous chemical. For this task, you may want to choose a public exposure guideline, since these guidelines are specifically designed for your purpose. In fact, the developers of the North American Emergency Response Guidebook (the "ERG") used the ERPG-2, a public guideline, whenever possible to prepare recommended isolation and evacuation distances for the chemicals included in the guidebook.

However, relatively few public exposure guidelines have yet been defined. For this reason, you sometimes might be able to find a workplace limit for a particular chemical, but no public guideline. No clear rules describe what you should do if you're in this situation, and your goal is to assess the hazard to the general public posed by a release of that chemical. You do have some options, however:

First, you may wish to consider using a TEEL (Temporary Emergency Exposure Limit) as your Level of Concern. TEELs are temporary limits defined by the U.S. Department of Energy, designed to be used as exposure limits for chemicals for which ERPGs have not yet been defined. It's important to understand that TEELs are only approximations, and unlike ERPGs, are not based on careful analysis of experimental data. You'll find links to references explaining how TEELs were derived, and listing current TEEL values, at <http://response.restoration.noaa.gov/cameo/locs/LOCpage.html>.

Second, you may wish to consider using a workplace limit if no other potential Level of Concern is available or if you don't have time to search for a more appropriate Level of Concern. However, if you're considering this option, be aware that:

- These limits were designed to protect workers, not for use in assessing hazard to people exposed during an accidental release.
- On the one hand, because age, health, and exertion influence how susceptible people will be to a pollutant, it's possible that some workplace limits may underestimate risk to the old, young, or sick members of the general population. On the other hand, because workplace limits incorporate safety factors, some may be overly protective Levels of Concern, which may not be warranted for the situation you are dealing with.

In Summary

For ALOHA's results to be useful to you, you must use accurate values for model inputs such as stability class or tank size. You also must choose a Level of Concern that's appropriate for the scenario you're modeling. As much as possible, your Level of Concern should:

- represent the hazard or effect that you're concerned about,
- be appropriate for air modeling,
- have a contact duration appropriate for your scenario, and
- reflect hazard to the population that you're concerned about.